ACCESSION #: 9606070228

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Browns Ferry Nuclear (BFN) Plant Unit 3 PAGE: 1 OF 6

DOCKET NUMBER: 05000296

TITLE: Unit 3 Scram On Low Reactor Water Level Due To Failure Of

The Steam Packing Exhauster Bypass Flow Control Valve

EVENT DATE: 05/01/96 LER #: 96-003-00 REPORT DATE: 05/30/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR

SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Steve Austin, Licensing Engineer TELEPHONE: (205) 729-2070

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: SJ COMPONENT: FCV MANUFACTURER: F127

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On May 1, 1996, at approximately 1110 hours, a full reactor scram on low reactor water level occurred. At 1109 hours, a "Condensate Booster Pump Suction Pressure Low" alarm was received in the Unit 3 Main Control Room. This alarm resulted from the closure of the Steam Packing Exhauster Condensate Bypass Valve. At 1110 hours, the "A" reactor feedwater pump tripped. The reactor automatically scrammed when the vessel level reached +11.2 inches. At -45 inches the High Pressure Coolant Injection and Reactor Core Isolation Cooling systems auto initiated and injected into the vessel. The automatic Engineered Safeguard Features and automatic isolation or actuations occurred

as expected. The cause of the valve failure was a material defect in the valve shaft. Specifically, the shaft contained a material defect in a notch sensitive area when subjected to transients that caused rapid valve position changes, resulted in high stresses being placed on the shaft, causing the shaft to fail. Additionally, personnel involved in disposition of a crack in the shaft inappropriately determined the condition acceptable.

The valve and pneumatic operator was replaced with a manual operator. This operator will remain in place until disposition of the system design. TVA is evaluating the design of the Steam Packing Exhauster Condensate Bypass Valve to see if design enhancements can be made that could prevent recurrence of this type of event. The Engineering individuals involved in the event received personnel corrective actions. TVA will provide information to the applicable personnel on management's expectations for evaluating plant conditions.

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I. PLANT CONDITIONS

Units 2 and 3 were operating at approximately 100 percent power

(3293 megawatts thermal). Unit 1 is shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event

On May 1, 1996, at approximately 1110 hours a low reactor water

level scram occurred.

At 1109 hours, a "Condensate Booster Pump Suction Pressure Low"

alarm [ALM] was received in the Unit 3 Main Control Room. This

alarm was the result of the closure of the Steam Packing

Exhauster Condensate Bypass Valve [SF] [FCV]. Subsequently,

TVA has concluded that the valve shaft failed during this

event. The valve failed closed. However, due to the flow

induced forces on the valve, the disk partially reopened.

As a result of the alarm, the unit operator (UO) [Utility,

Licensed] initiated a reduction of the recirculation pump [AD] speed to approximately 60 percent. At about the same time the UO reduced the recirculation pump speed, the "A" condensate booster pump tripped on low suction pressure.

At 1110 hours, the "A" reactor feedwater pump [SK] tripped. The reactor automatically scrammed when the vessel level reached +11.2 inches. At -45 inches the High Pressure Coolant Injection (HPCI)[BJ] and Reactor Core Isolation Cooling (RCIC) [BN] systems auto initiated and injected into the vessel. Furthermore, Alternate Rod Injection [JE] automatically initiated.

In addition to the above actuations, the scram resulted in the actuation or isolation of the following Primary Containment Isolation [JE] (PCIS) systems/components.

o PCIS group 2, shutdown cooling mode of Residual Heat Removal [BO] system; Drywell floor drain isolation valve, Drywell equipment drain sump isolation valve [WP]

o PCIS group 3, Reactor Water Cleanup [CE]

o PCIS group 6, Primary Containment Purge and Ventilation [JM]; Unit 2 Reactor Zone Ventilation [VB]; Refuel Zone Ventilation [VA]; Standby Gas Treatment (SGT) [BH] system; Control Room Emergency Ventilation (CREV) [VI]

o PCIS group 8, Transverse Incore Probe [IG].

The reactor scram was reset by 1120 hours and the affected systems returned to service by 1141 hours. A Reactor Feed Pump was placed into service to maintain reactor level and RCIC was returned to standby readiness by 1148 hours. All safety systems responded as expected during the reactor scram.

This event is reportable in accordance with 10 CFR 50.73 (a)(2)(iv), as any event or condition that resulted in manual or automatic actuation of any engineered safety feature including the reactor protection system.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

May 1, 1996, at 1110 CDT The Unit 3 reactor received a full scram due to low reactor water level.

May 1, 1996, at 1120 CDT The scram was reset.

May 1, 1996, at 1203 CDT TVA made a 1 hour notification to NRC in accordance with 10 CFR 50.72 (b)(1)(iv) for HPCI injection.

D. Other Systems or Secondary Functions Affected:

Following this event, the UO attempted to restart the Reactor

Recirculation [AD] pumps. Pump 3A failed to initially start. However, it was eventually returned to service. Pump 3B was successfully returned to service.

All three of the Low Pressure Feedwater Heater strings isolated as required during the event. However, due to problems with the valve operators they could not be immediately returned to service. TVA has concluded the isolation valve operators experienced thermal overload or torque switch problems. Therefore, the UO controlled vessel level utilizing RCIC until the low pressure feedwater heater strings could be unisolated and the feedwater system returned to service. TVA is tracking this issue through the corrective action program.

E. Method of Discovery:

The event was immediately known to the Unit 3 Main Control Room Operators upon receiving a "Condensate Booster Pump Suction Pressure Low" alarm. This was followed by the reactor scram and subsequent ESF actuations.

F. Operator Actions:

Operator actions taken during this event were in accordance with applicable procedures. At the onset of the event, the UO attempted to reduce the reactor power to return the reactor water level to normal. At +12 inches, the Assistant Shift

Operations Supervisor (Utility, Licensed) directed the reactor to be manually scrammed. However, before the manual scram could be completed, the reactor received an automatic scram at +11.2 inches (low-water level). The reactor operator then performed actions described by Abnormal Operating Instruction "Reactor Scram," bringing the reactor to hot standby condition.

G. Safety System Responses:

The safety systems listed in Section II.A of this report responded to the reactor scram as designed.

III. CAUSE OF THE EVENT

A. Immediate Cause:.

The immediate cause of the reactor scram was the failure of the shaft connecting the valve disk to the actuator resulting in a loss of control of the disk. This was followed by trip of two of the condensate booster pumps and one reactor feedwater pump on low suction pressure.

B. The Cause Of The Event:

The root cause of the valve failure was a material defect in the valve shaft. Specifically, the shaft contained a material defect in a notch sensitive area when subjected to transients that caused rapid valve position changes, resulted in high stresses being placed on the shaft, causing the shaft to fail. Metallurgical analysis of the shaft supports the conclusion

that failure was related to high stress impacts, resulting in complete torsional failure of the shaft. BFN was experiencing erratic valve operation, which on occasion, the valve would slam closed then reopen. This erratic operation resulted in cracks in the operator [FCO] mounting bracket and the valve shaft.

TVA had an opportunity to prevent the reactor scram. A crack on the valve stem was detected by craft personnel during maintenance activities on the valve. Engineering evaluation and acceptance of the condition were not adequate. The personnel involved in the disposition of the crack inappropriately determined the condition of the shaft acceptable.

IV. ANALYSIS OF THE EVENT

Plant safety systems and associated components performed as designed during the event. Operations personnel stabilized the reactor in accordance with applicable plant procedures.

There were no operator actions that could have prevented this event.

The Steam Packing Exhauster Condensate Bypass Valve is a single point failure with high scram potential. Closure of the valve at 100 percent reactor power has in the past lead to a low-water level reactor scram. The failure of the valve resulted in the trip of two

condensate booster pumps and one reactor feedwater pump on low suction pressure; thereby, resulting in a low-reactor water level scram.

This event was categorized as a partial loss of reactor feedwater. Full loss of feedwater is an analyzed plant transient and bounds the circumstances associated with this event. Therefore, the event did not affect the health and safety of plant personnel or the public.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

The affected systems were restored to operable status. The valve was replaced with a manual valve.

B. Corrective Actions to Prevent Recurrence:

1. The original operator (an air operator) was replaced with a manual operator. This operator will remain in place until disposition of the system design can be finalized.

2. The Engineering personnel involved in the event received personnel corrective action in accordance with TVA policy.

3. In order to address the single point failure aspect of the valve, TVA is evaluating the design of the Steam Seal Condenser [COND] and Steam Packing Exhauster Condensate Bypass Valve to determine if design enhancements could be made to prevent recurrence of this type of event.

4. TVA will provide the applicable personnel information

regarding management's expectations for evaluating plant conditions. 1_/

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1_/ TVA does not consider these actions Regulatory Commitments. That is, they are not actions required to restore compliance with obligations. Obligation means an action that is a legally binding requirement imposed through applicable rules, regulations, orders, and licenses.

The TVA corrective action program will track completion of the corrective actions 3 and 4.

VI. ADDITIONAL INFORMATION

A. Failed Components:

The valve shaft in a Fisher Company model number 7600, 16 inch air operated butterfly experienced a complete torsional failure.

B. Previous LERs on Similar Events:

No previous BFN events were identified in which the Steam Packing Exhauster Condensate Bypass Valve experienced a failure of the valve shaft. However, LER 260/91017 describes an event which the air line to the Unit 2 Steam Packing Exhauster Condensate Bypass Valve operator failed and the valve closed. This single point failure resulted in scram of Unit 2. The

corrective actions for LER 260/91017 would not have prevented

this event.

VII. COMMITMENTS

None.

Energy Industry Identification System (EIIS) system and component codes

are identified in the text with brackets (e.g., [XX]).

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TVA

Tennessee Valley Authority, Post Office Box 2000,

Decatur, Alabama 35609-2000

R. D. (Rick) Machon

Vice President, Browns Ferry Nuclear Plant

May 30, 1996

U. S. Nuclear Regulatory Commission 10 CFR 50.73

ATTN: Document Control Desk

Washington, D.C. 20555

Gentlemen:

In the Matter of)

Tennessee Valley Authority)

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - DOCKET

NOS. 50-259, 260, AND 296 - FACILITY LICENSE DPR-33, 52,

AND 68 - LICENSEE EVENT REPORT 50-296/96003

The enclosed report provides details concerning a reactor scram on low reactor water level following the failure of the Steam Packing Exhauster Condensate Bypass Valve.

The shaft connecting the valve disk to the operator failed resulting in momentary closure of the valve. This action was followed by tripping of two of the condensate booster pumps and one feedwater pump thus causing a low reactor water level.

TVA has determined that this valve is a single point failure with high scram potential. Therefore, TVA is evaluating the design of the Steam Seal Condenser and Steam Packing Exhauster Condensate Bypass Valve to determine if design enhancements can be made to prevent recurrence of this type of event.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv) as a condition that resulted in automatic actuation of any engineered safety feature including the reactor protection system.

There are no commitments made in this submittal. If you have any questions regarding this, please contact Pedro Salas at (205) 729-2636.

Sincerely,

R. D. Machon

Enclosure

cc (Enclosure):

Mr. Mark S. Lesser, Branch Chief

U. S. Nuclear Regulatory Commission

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